

WHAT IS CLAIMED IS:

1. A magnetic memory device comprising:

a plurality of magneto-resistance effect elements arranged in a matrix form,

5 wherein each of the plurality of magneto-resistance effect elements has a pattern shape which substantially internally touches an ellipse having major and minor axes of the magneto-resistance effect element as major and minor axes thereof and a pitch between the adjacent magneto-resistance effect elements in a direction of the major axis is longer than that in a direction of the minor axis.

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2. A magnetic memory device according to claim 1, wherein at least part of the outer periphery of the magneto-resistance effect element has a shape which projects in an inward direction of the magneto-resistance effect element.

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3. A magnetic memory device according to claim 2, wherein the sides of each magneto-resistance effect element are curved toward the center of the magneto-resistance effect element, each side extending along an arc of an ellipsis.

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4. A magnetic memory device according to claim 1, wherein an area of the magneto-resistance effect element is smaller than an area of an ellipse having the major and minor axes of the magneto-resistance effect element as major and minor axes thereof.

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5. A magnetic memory device according to claim 1, wherein the magneto-resistance effect element includes a fixing layer, tunnel barrier layer, recording layer and cap layer.

5 6. A magnetic memory device according to claim 1, further comprising first write wirings formed below the magneto-resistance effect elements and second write wirings formed on the magneto-resistance effect elements to intersect with the first write wirings.

10 7. A method of manufacturing a magnetic memory device comprising:

forming a material used to form magneto-resistance effect elements on a main surface of a semiconductor substrate,

15 forming a photoresist on the material used to form the magneto-resistance effect elements,

respectively forming opening portions in the photoresist in central portions of forming regions of every four adjacent magneto-resistance effect elements,

20 equally enlarging the opening portions by isotropically etching the opening portions and causing at least two end portions of the opening portion in a major axis direction and two end portions thereof in a minor axis direction to overlap with end portions of the adjacent opening portions in a major axis direction and end portions of the adjacent opening portions in a minor axis direction, and

forming a plurality of magneto-resistance effect elements by etching the material used to form the magneto-resistance effect elements with the remaining photoresist used as a mask.

5        8. A method of manufacturing a magnetic memory device according to claim 7, further comprising forming first write wirings on a main surface of the semiconductor substrate before forming the material used to form the magneto-resistance effect elements.

10        9. A method of manufacturing a magnetic memory device according to claim 7, further comprising forming an inter-level insulating film on the entire surface after the forming the plurality of magneto-resistance effect elements with the remaining photoresist used as the mask, and forming second write wirings to intersect with the first write wirings in portions of the inter-level insulating film which correspond to positions lying above the magneto-resistance effect elements.

15        10. A method of manufacturing a magnetic memory device comprising:

      forming a material used to form magneto-resistance effect elements on a main surface of a semiconductor substrate,

20        forming a first hard mask member on an entire surface of the material used to form the magneto-resistance effect elements,

      forming a second hard mask member on an entire

surface of the first hard mask member,

forming a photoresist on an entire surface of the second hard mask member,

5 forming a first opening portion in the photoresist in each central position of forming regions of every four adjacent ones of the magneto-resistance effect elements by use of a rectangular mask pattern,

10 forming second opening portions in the second hard mask member by using the photoresist in which the first opening portions are formed as a mask,

removing the photoresist used as the mask,

15 equally enlarging the second opening portions by isotropically etching the second opening portions and causing at least two end portions of the second opening portion in a major axis direction and two end portions thereof in a minor axis direction to overlap with end portions of the adjacent second opening portions in a major axis direction and end portions of the adjacent second opening portions in a minor axis direction, and

20 forming a plurality of magneto-resistance effect elements having a hard mask layer by etching the first hard mask member and the material used to form the magneto-resistance effect elements with the remaining portion of the second hard mask member used as a mask.

25 11. A method of manufacturing a magnetic memory device according to claim 10, further comprising forming first write wirings on a main surface of the

semiconductor substrate before forming the material used to form the magneto-resistance effect elements.

12. A method of manufacturing a magnetic memory device according to claim 10, further comprising forming an inter-level insulating film on the entire surface after the forming the plurality of magneto-resistance effect elements, and forming second write wirings to intersect with the first write wirings in portions of the inter-level insulating film which lie above the plurality of magneto-resistance effect elements having the hard mask layer.

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